LIVERMORE LAB
# REPORT

**A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Dec. 9-13, 2013.**

## San Jose Mercury News EYE ON THE PRIZE


When the Organization for the Prohibition of Chemical Weapons was handed the 2013 Nobel Peace Prize Award earlier this week, chemists at Lawrence Livermore Laboratory had something to celebrate.

The Laboratory is one of only two such laboratories in the country certified by the OPCW -- a multinational organization headquartered in the Netherlands -- to analyze samples for chemical warfare agents under terms of the international Chemical Weapons Convention. The Lab's Forensic Science Center oversees the work and is funded by the National Nuclear Security Administration.

"Our OPCW work, along with the efforts of the other 20 laboratories (worldwide), provides an important international security capability by helping to verify and ensure compliance with the Chemical Weapons Convention," Brad Hart, head of the Forensic Science Center, said. "For an international organization like this to succeed, it is necessary to have cutting-edge technology and expertise that provide confidence in the verification process."

To read more, go to the *San Jose Mercury News*.

## MPRnews AS THE WORLD WARMS

Manmade climate change is causing glaciers to melt faster than by natural influences alone.

In 1995, Lawrence Livermore climate scientist Ben Santer brought up the notion that humans were partially to blame for a warming planet. His views on climate change, backed by stacks of data, have gone from being in the extreme minority to the near-universally accepted majority.

"The warming we have seen in these many different aspects of the climate system -- the ocean, the land surface, the ice, the atmosphere, water vapor, pressure patterns, circulation patterns -- these changes cannot be purely explained by natural causation," Santer said. "You need a substantial human influence in order to best explain the observed changes we've seen."

Santer said the frequency of extreme weather events has helped people understand the impact of climate change.

To listen to more, to *Minnesota Public Radio*.

**The magenta spots in this image show two black holes in the spiral galaxy called the Topsy Turvy galaxy. Both medium-sized black holes belong to a class called ultraluminous X-ray sources.**

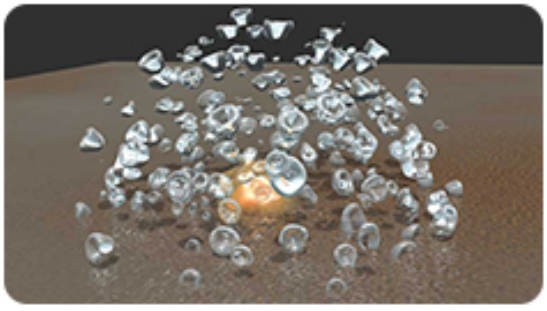
Black holes can be petite, with masses only about 10 times that of our sun -- or monstrous, boasting the equivalent in mass up to 10 billion suns. But most recently, NASA's Nuclear Spectroscopic Telescope Array, or NuSTAR, which Lawrence Livermore has played a major role, is busy scrutinizing a class of black holes that may fall into the proposed medium-sized category.

The largest black holes, referred to as supermassive, dominate the hearts of galaxies. The gravity of these black holes drags material toward them, forcing the material to heat up and release powerful X-rays. Small black holes dot the rest of the galactic landscape. They form under the crush of collapsing, dying stars bigger than our sun.

Evidence for medium-sized black holes lying somewhere between these two extremes might come from objects called ultraluminous X-ray sources, or ULXs, which are found throughout galaxies. These are pairs of objects in which a black hole ravenously feeds off a normal star. The feeding process is somewhat similar to what happens around supermassive black holes, but isn't as big and messy.

To read more, go to *Science Daily*.

internet evolution **BURSTING THE BUBBLE**



Lawrence Livermore scientists and collaborators set a new record in supercomputing in fluid dynamics by resolving unique phenomena associated with clouds of collapsing bubbles. Image courtesy of Petros Koumoutsakos zVg/CSE Laboratory, ETH Zurich.

Scientists at ETH Zurich and IBM Research, in collaboration with the Technical University of Munich and the Lawrence Livermore National Laboratory, have set a new record in supercomputing in fluid dynamics using 6.4 million threads on LLNL's 96-rack "Sequoia" IBM BlueGene/Q -- one of the fastest supercomputers in the world.

The simulations resolved unique phenomena associated with clouds of collapsing bubbles, which have several potential applications including:

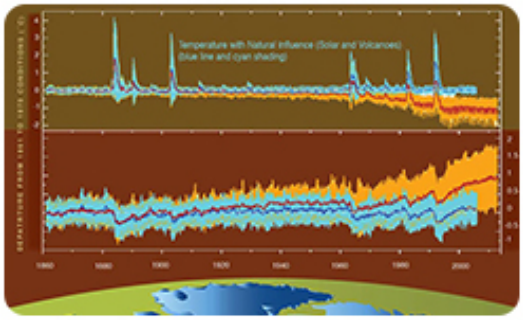
- Improving the design of high-pressure fuel injectors and propellers
- Shattering kidney stones using the high pressure of the collapsing bubbles
- Emerging therapeutic modality for cancer treatment by using bursting bubbles to destroy tumorous cells and precise drug delivery

The team of scientists performed the largest simulation ever in fluid dynamics, using 73 percent of Sequoia's theoretical peak.

The work earned the team a Gordon Bell Award at SC13.

To read more, go to Internet Revolution.

The Almagest **WHAT GOES UP**



**A graphic representation of the fingerprints, both manmade and natural, on the vertical structure of the atmosphere.**

Human influences have directly impacted the latitude/altitude pattern of atmospheric temperature.

That is the conclusion of a recent report by scientists from Lawrence Livermore National Laboratory and six other scientific institutions. The research compares multiple satellite records of atmospheric temperature change with results from a large, multi-model archive of simulations.

Observational satellite data and the computer model-predicted response to human influence have a common latitude/altitude pattern of atmospheric temperature change. The key features of this pattern are global-scale tropospheric warming and stratospheric cooling over the 34-year satellite temperature record. (The troposphere is the lowest portion of Earth's atmosphere. The stratosphere lies above the troposphere.)

So while the temperature in the troposphere is going up, humans are feeling the effects down below.

To read more, go to The Almagest

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